UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 16 2009

OFFICE OF
AIR AND RADIATION

Dave Moody, PhD.
Manager, Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221-3090

Dear Dr. Moody:

The U.S. Environmental Protection Agency (EPA) received the U.S. Department of Energy's (DOE) 2009 Compliance Recertification Application (CRA-2009) for the Waste Isolation Pilot Plant (WIPP) on March 24, 2009. On May 21, 2009, we provided you with our first comments related to completeness of the CRA-2009 documentation. In our ongoing review, we have identified additional information needed to constitute a complete application.

Please note that EPA's review of CRA-2009 continues, and included an on-site review during the week of May 18, 2009. As a result of this on-site review, EPA requested a number of documents related to waste inventory, performance assessment calculations and code documentation, human intrusion, and chemistry. EPA believes that these documents will be instrumental in our continuing CRA-2009 review. However, the Agency has a few additional comments which DOE must address. These comments are related to stakeholder comments on shallow hydrology, inventory documentation, chemistry, and human intrusion. As EPA continues its CRA-2009 completeness review, we anticipate at least one more completeness letter this summer after we have been able to review all of the additional information delivered by DOE.

EPA appreciates DOE providing the requested documents in a timely manner. The documents listed in the enclosure are those we do not appear to have received. If you have any questions regarding these issues, please contact Tom Peake at (202) 343-9765.

Sincerely,

Elizabeth Cotsworth

Elizabeth Cotsworth, Director
Office of Radiation and Indoor Air

Enclosure

cc: Electronic Distribution
Frank Marcinowski, DOE/EM
Russ Patterson, DOE,CBFO
Steve Zappe, NMED
Nick Stone, EPA Region 6

Enclosure: CRA-2009 Second (2) Completeness Letter

General Comments

2-G-4 Inventory-Quality Assurance Sign-offs

While reviewing some of the quality assurance documents used by the LANL-CO inventory team to develop, manipulate and maintain the WIPP waste inventory, we note that the sign-off procedure varies from document to document. In particular, some documents were signed off by the Quality Assurance Manager while others were not. Of the documents we have reviewed, INV-SAR-01, INV-SAR-13, INV-SAR-16, INV-SP-01 and INV-SP-02 do not have QA signoffs. Documents INV-SAR-02, INV-SAR-15, and PAIR 2008 do have QA sign-offs. DOE should explain this apparent discrepancy in their review procedures as to why some inventory documents have QA sign-off and other comparable documents do not.

40 CFR 194.15 Content of Compliance Re-certification Application(s)

CARD 2009 Recertification Comments (as noted in the 1st completeness letter)

The group, Citizens Against Radioactive Dumping (CARD), has submitted a report entitled, "Proof of Rapid Rainwater Recharge at the WIPP Site," by Dr. Richard Hayes Phillips, dated March 25, 2009, as comments for the 2009 recertification of WIPP. Based on our review, the report raises a number of possible challenges to aspects of the WIPP conceptual models.

For this recertification, it is appropriate and necessary for DOE to respond to these challenges as clearly and directly as possible. EPA will consider CARD's report and DOE's responses as part of our review, deliberation, and potential approval of continued compliance at WIPP. If DOE believes there are additional questions related to this report that need to be addressed to make the record clear and complete, please add them as appropriate.

CARD Model Challenges:

2-15-CARD-1: page 1, last line- CARD states, "This is why the proponents of WIPP deny the existence of karst at the WIPP site. They argue, in effect, that WIPP is a karst-free island in the midst of a regional karstland."

2-15-CARD-2: page 2, first line- CARD states, "The supposed reliability of the Rustler Formation as a barrier to the migration of contaminated water hangs upon a postulated lack of rainwater."

2-15-CARD-3: page 2, third paragraph- CARD states, "Proof of rainwater recharge at the WIPP site would constitute proof that WIPP is part of the regional karstland of the Pecos River Valley."

2-15-CARD-4: page 3, third paragraph- CARD states, "This is the very definition of karst. Simply stated, if rainwater recharge does reach the Culebra dolomite, the Culebra is not a confined aquifer, and the conceptual model is wrong. If test wells in other water-bearing rocks also respond to rainfall the Culebra is not the only groundwater pathway, and the conceptual model is wrong."

2-15-CARD-5: page 4, paragraph 2- CARD states, "But the point to remember is this: none of this rainwater recharge is supposed to be happening. This invalidates the groundwater model upon which the certification of WIPP was based."

2-15-CARD-6: page 14 last line- CARD states, "This strongly suggests that the water table will continue to rise at the WIPP site. Thus the Culebra is not in hydraulic steady state, as hypothesized in the conceptual model, on the basis which the WIPP was certified."

2-15-CARD-7: page 30, first paragraph- CARD states, "If groundwater is supposed to be flowing from north to south, as DOE contends, how then did dissolved halite appear in these test wells? ...There is halite in the Rustler only to the east, which requires a westerly component to groundwater flow."

2-15-CARD-8: page 36, 6th paragraph- CARD states in conclusion, "Proof of rapid rainwater recharge at the WIPP site renders invalid the hydrologic model of the Culebra by which the WIPP site was certified by the Environmental Protection Agency. Because rainwater recharge does reach the Culebra dolomite, dissolution of overlying evaporates is occurring, the Culebra is not in hydraulic steady state, the Culebra is not a confined aquifer, and the Culebra is not the only potential pathway for

contaminated water. But the fundamental problem is not with the model. Revising the model, or designing a new one, will not solve the problem. The WIPP is not suitable for long-term waste isolation."

40 CFR 194.23 – Performance Assessment Models and Computer Codes

Chemistry (C) Issues

2-C-24 Inventory-Chemistry

The PA team requested data on the cement inventory as documented in PAIR 2008 (Crawford et al. 2009, Section 3.1). The scaled mass of cement was reported to be 1.23×10^7 kg (Table 4-11). This mass of cement is about 40% higher than the cement mass of 8.83×10^6 kg from the PABC inventory (DOE 2006, Section 3.2.3.1) and about 44% higher than the cement mass of 8.54×10^6 kg reported in the CCA (DOE 1996 Appendix WCA). The likely effects of cement on repository performance were not discussed in CRA 2009 Appendices SOTERM or Appendix PA (DOE 2009). In CRA 2004, it was noted that cement could be a source of mineral-fragment-type colloids (DOE 2004, Appendix PA, Attachment SOTERM, page 31). It was also noted in CRA 2004 (DOE 2004 Chapter 6, page 6-87) that the amount of portlandite [$Ca(OH)_2$] associated with Portland cement used to dewater sludges is insufficient to overcome the buffer capacity of the MgO backfill.

The possible effects of cement on actinide solubilities through its influence on the pH of intruding brines were addressed in the CCA (DOE 1996 Appendix SOTERM, Section 2.2.2, pages SOTERM-6 through SOTERM-17). However, the calculations used to determine that pH would be controlled by the dissolution of brucite rather than portlandite were based on the CCA inventory amounts of MgO and cementitious materials. Since the CCA, as noted above, the amount of cement has increased significantly and the MgO excess factor has been reduced from 1.95 to 1.2. DOE should discuss the consequences of the changed amounts of MgO and cement in the repository on pH buffering of intruding brines and possible impacts on actinide solubilities.

Crawford, B., D. Guerin, S. Lott, B. McInroy, J. McTaggart, and G. Van Soest. 2009. *Performance Assessment Inventory Report – 2008*. INV-PA-08, Rev. 0, LA-UR-09-02260, Los Alamos National Laboratory Carlsbad Operations.

DOE 1996. *Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant*, DOE/CAO-1996-2184, October 1996, Carlsbad Field Office, Carlsbad, New Mexico.

DOE 2004. *Title 40 CFR 191 Parts B and C Compliance Recertification Application*, DOE/WIPP 2004-3231, Carlsbad Field Office, Carlsbad, New Mexico, March 2004.

DOE 2006. Transuranic Waste Baseline Inventory Report - 2004, DOE/TRU-2006-3344, Revision 0, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, NM.

DOE 2009. *Title 40 CFR 191 Parts B and C Compliance Recertification Application*, Carlsbad Field Office, Carlsbad, New Mexico, March 2009.

2-23-7. Adequacy of Minimum Brine Calculations for Actinide Solubility Determinations

The minimum brine volume is the volume of brine needed for a direct brine release (DBR) to occur during an intrusion scenario. Furthermore, the potential concentration of organic ligands in brine present in WIPP disposal rooms is used as an input in the calculations of actinide solubilities for the WIPP Performance Assessment (PA). Since the total amount of organic ligands in the WIPP waste

inventory is known, it is necessary to determine the volume of brine into which these ligands are assumed to dissolve.

There have been several efforts to estimate this volume in the compacted TRU waste for the WIPP. Prior to the 1996 Compliance Certification Application (CCA), Larson (1996) estimated this volume, calculated at 2000 years after repository closure with an assumption of no gas generation, to be 343 m^3 per room and a minimum brine saturation of 0.75 for 116 equivalent rooms. This led to a repository-scale volume of 29,841 m^3. Under these assumptions, this was the minimum brine volume needed for DBR.

Since this initial calculation, Stein (2005) provided a reassessment of this minimum volume by making the following changes: (1) it was based on the structural results used in the final calculations of the CCA PA, (2) the time of the calculation was extended from 2000 to 10,000 years after repository closure, (3) a corrected waste-filled repository volume was used, and (4) the residual brine saturation was fixed at 0.276. These changes led to an overall repository-scale volume of 10,011 m^3. This value was used in the PABC-2004 and CRA-2009. The model was subsequently modified further in 2006 and 2008 to disconnect the minimum brine pressure from results of previous performance assessments.

The current concern is whether this minimum volume used in the calculations of actinide solubilites and DBRs is realistic [or conservative] with respect to potential repository conditions. As described in Hansen et al. 2005, the porosity surfaces created for the original certification and those created subsequently for other possible waste packages, did not and do not include the structural effects of degradation, nor do they include structural effects of MgO hydration, salt precipitation, and corrosion by-products. Hanson et al. (2005) note that all of these processes would occur if a significant amount of brine enters the waste room and the hypothetical gas generation scenarios ensue in the WIPP underground. Hansen et al. (2005, p. 14) state that, "*The manner in which room closure is considered in the performance assessment today is based on two contradictory future states of the waste: one of degradation to produce gas and another of intact 55-gallon drums for room closure calculations. As it turns out in these analyses, when any significant gas is generated the mechanical response of the waste has little to do with room closure because the gas holds the room open and waste compression ceases. A proper model for room closure would involve compaction of waste, hydration of MgO, and precipitation of salt in proportion to the volume of brine consumed.*"

With respect to the impact of the porosity surface on performance assessment, analyses by Hansen et. al. (2004) found that the repository conditions are not greatly affected by the uncertainty in waste structural properties and spatial arrangement, as characterized by the uncertainty in the porosity surface. They concluded that a single porosity surface is appropriate for performance assessment. From a minimum brine volume perspective, however, it is unclear whether the current calculations adequately describe the potential minimum porosities from which minimum brine volumes are subsequently determined. These porosities may be higher simply from the fact that in the current modeling the gas holds the room open, when in actuality this may not be the case. Hansen et al. (2005) further point out that other geochemical processes may lead to lower porosities: "*The introduction of brine from the intrusion will start gas generation processes and pressures would increase. If the panel has had 100 years or more to consolidate, presumably there will not be all that much pore space for brine to fill and further hydration and corrosion may effectively plug much of the remaining pore space after the intrusion.*"

DOE should provide appropriate justification that the porosity surface used to develop room void volumes does not overstate the void volumes leading to higher required brine volumes to support DBRs

and lower organic ligand concentrations.

Hansen, C. W., 1. S. Stein and B. Zelinski. 2004. Effect of Waste Porosity Modeling on AMW Performance Assessment. ERMS#534130. Sandia National Laboratories, Carlsbad NM.

Hansen, C. W., J. S. Stein and B. Zelinski. 2005. WIPP Room Evolution and Performance Assessment Implications ERMS#538870. Sandia National Laboratories,rlsbad NM.

Larson, K., 1996, Brine-Waste contact volumes for scoping analysis of organic ligand concentration: Albuquerque, NM, WPO# 36044.

Stein, J.S. 2005. Memorandum to L.H. Brush (Subject: Estimate of Volume of Brine in Repository That Leads to a Brine Release). 13 April 2005. ERMS 539372. U.S. Department of Energy, Sandia National Laboratories, Albuquerque, NM

40 CFR 194.33 Consideration of Drilling Events in Performance Assessments

Human Intrusion-Related Issues

2-33-1 Please provide the following reference, or indicate where the reference is located in the data sets provided:

- B.L. Resources, *Monthly Injection & Saltwater Report for Southeast New Mexico,* May, 2007

2-33-2 40 CFR 194.33(c)(2) states: (c) Performance assessments shall document that in analyzing the consequences of drilling events, the Department assumed that…(2) Natural processes will degrade or otherwise affect the capability of boreholes to transmit fluids over the regulatory time frame. Brine extraction wells in the vicinity of WIPP have experienced significant failures and collapse of formations near surface due to creation of cavernous features at depth. Recently, the Energy and Minerals Department Secretary Joanna Prukop directed the Oil Conservation Division to evaluate current rules and regulations governing brine wells, including an internal audit and well inspections. While brine wells are considered in the CRA-2009, it is unclear whether additional analysis was performed to determine whether any unforeseen elements that contributed to recent issues may impact CRA assumptions, and whether these should be further considered as part of the CRA-2009. That is, it is unclear whether these recent phenomenon have been considered, and how, or if, these may affect the transmissivity of formations above the solution collapse. Further, the root cause of these failures should be assessed with respect to well completion practices to determine if factors other than brine extraction (i.e. downward flow of fresh water within a poorly cemented annulus) may have impacted dissolution. Related to this, it is unclear whether the CRA-2009 has assessed injection well integrity for those wells within the 9-township boundary, as no references for this analysis were included in the CRA-2009.

2-33-3 Dakota Salts, LLC, is a Denver based company that has proposed the use of Deep Salt Caverns for storage of compressed air generated by windfarms. Dakota Salts currently has eight salt caverns in North Dakota and, according to their website, is "…prepared to enter the regulatory and permitting stage and is working with the North Dakota Industrial Commission and North Dakota Department of Mineral Resources to establish the State's first regulatory control project" for storage of compressed air that would be released through windfarm operations during periods of low wind generation. The CRA-2009, including the DBMR[1], does not address whether there are any known plans to use existing salt or potash mines for this purpose.

2-33-4 Carbon sequestration is being assessed on a nationwide basis, including the Permian Basin (http://www.southwestcarbonpartnership.org/). The Southwest Regional Partnership (SWP), was selected by the U.S. Department of Energy and its National Energy Technology Laboratory (NETL) as one of seven regional partnerships charged with evaluating available technologies to capture and to reduce the emissions intensity of greenhouse gases in the southwest region through a process known as carbon sequestration. The project includes several different analyses such as CO_2 coalbed sequestration, saline aquifer CO_2 sequestration (i.e. injection into saline water-bearing formations), and terrestrial/biotic sequestration. New Mexico was included in the SWP evaluations, as the state contains several highly saline water-bearing intervals that may offer sequestration opportunities. While elements of CO_2 sequestration are addressed in different HI

[1] DMBR – Delaware Basin Monitoring Annual Report

scenarios, CO_2 sequestration is not specifically identified in the human intrusion analysis.

2-33-5 In CRA-2009, DOE changed the maximum time a DBR can occur from 11 days to 4.5 days. The maximum DBR duration is represented in PA by the parameter MAXFLOW and used in the code BRAGFLO. The CRA-2009 states "Kirkes (2007) documents that this change is in keeping with current drilling practices within the Delaware Basin and the previous assumption of 11 days was incorrect. Kirkes and Clayton (2008) document the impacts of reducing the maximum duration of DBR and show that this change has a very minor impact upon performance predictions. Appendix PA-2009, Section PA.9.3 discusses the contribution of DBR to total releases for the CRA-2009 performance calculations. Therefore, DOE continues to comply with 40 CFR § 194.33(c)."

Review of Kirkes (above, 2007) raised the following completeness questions:

a. The South Culebra Bluff Blowout is cited as an inappropriate analogy for a WIPP brine release based on the formation encountered, downhole pressures anticipated, gas content/ignition, etc. The document does not address whether there are analogies elsewhere (e.g. unanticipated brine pockets encountered at relatively shallow depths in salt formations) that are more representative of potential conditions anticipated at the WIPP.

b. Review of drillers' comments (Memorandum, Document Number 545844) indicates that many drillers have never encountered a situation that would require mitigation of a brine release or blow out at shallow depths in the Delaware Basin. Kirkes (2007) takes this into account by calculating the anticipated time it would take to acquire appropriate materials, but it is unclear whether the actual response time from the crew takes into account this lack of experience. Please indicate whether there are any other considerations short of material availability, that were considered when evaluating this circumstance.

c. Several drillers (reference 545844) indicated that they may never detect a brine release from the repository given the hypothetical release conditions posed by Kirkes (2007). While this may be improbable under the assumed downhole pressure conditions, the consequences that a lack of release detection would have with respect to release scenarios or performance assessment has not been addressed in the references reviewed or in Kirkes (2007). Please provide this information.

d. One driller interviewed in reference 545844 indicated that if a brine kick was encountered, he would probably let brine flow to surface without any attempt at mitigation. However, Kirkes (2007) and other references examined do not appear to address the likely duration of unmitigated flow and impact on PA assumptions. Please provide or cite references that address this occurrence.

e. Additionally, it is unclear what effect brine shut-in would have with respect to duration of flow and downhole conditions. Please provide references that address the effects that surface shut in (prior to brine kill) would have on downhole conditions below the surface casing, assuming that surface casing is set to approximately 900 ft with the remainder of the hole open. (At that point, intermediate casing would not have been set.)